

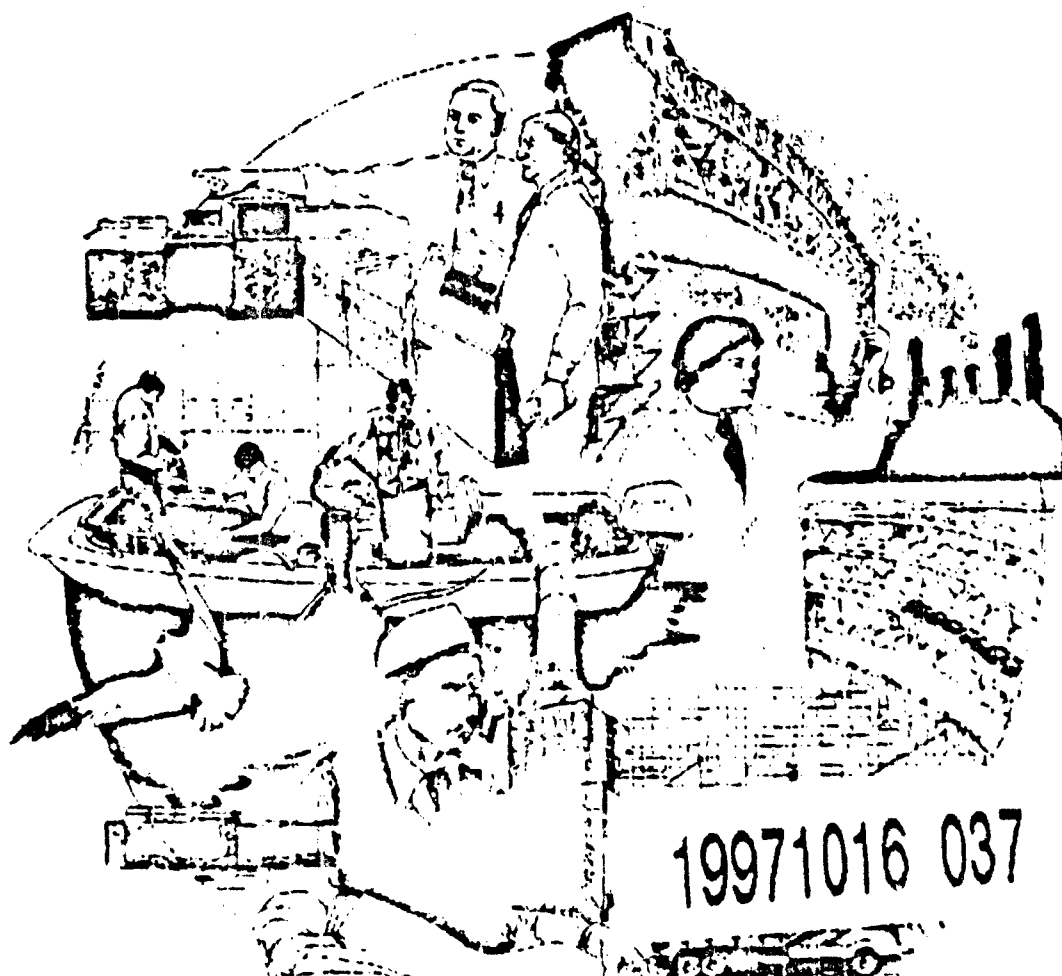
**WESTON**



Energy Engineering  
Analysis Program (EEAP)  
Final Report  
Volume I: Executive  
Summary

Military Ocean Terminal  
Bayonne, New Jersey (MOTBY)  
Department of the Army  
Contract No. DACA65-81-C-0020

January 1983



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ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

INCREMENTS A, B, AND C

at the

MILITARY OCEAN TERMINAL  
Bayonne, New Jersey  
(MOTBY)

FINAL REPORT

VOLUME I: EXECUTIVE SUMMARY


Prepared for:

Department of the Army  
Norfolk District, Corps of Engineers  
803 Front Street  
Norfolk, Virginia

Under Contract No. DACA65-81-C-0020

January 1983

  
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## PROJECT PARTICIPANTS

The following members of the staff of Roy F. Weston, Inc., have participated in the planning and execution of this project, and in the preparation of this report:

|  |  |
|--|--|
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| B. M. Gidweni, P.E.<br>Project Manager<br>Energy Department              | Design and Construction<br>Management Division |
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## SECTION I

### INTRODUCTION

As a result of the specific requirements of Increments A, B, and G of Contract No. DACA65-81-C-0020, WESTON has performed an extensive energy engineering analysis of various facilities at the Military Ocean Terminal, Bayonne, New Jersey (MOTBY). The analysis has included the following:

1. Site surveys.
2. Examination and inspection of system drawings.
3. Development of mechanical equipment lists.
4. Identification of equipment capacities and building loads.
5. Determination of utility energy consumption quantities and prices.

The study has similarly included the development and evaluation, according to U.S. Army ECIP criteria, of various energy conservation measures (ECM's). A significant number of preliminary opportunities were considered. Based on extensive review and consideration of total MOTBY operations, a final consensus listing was identified and detailed evaluations performed. This report lists the results of the detailed evaluation of the energy conservation measures and presents them as proposed ECIP projects. In addition, historical basewide energy consumption and the energy savings and energy cost savings based on implementation of the identified projects is included.

## SECTION 2

### EXISTING ENERGY CONSUMPTION

#### 2.1 BASEWIDE CONSUMPTION

Total basewide energy consumption according to fuel type for FY79 is summarized in Table 2-1. Partial records indicate that total energy consumption for baseline year FY75 was 979,200 MBtu (millions of Btu).

Table 2-1

#### Basewide Energy Consumption by Fuel Type - FY79

| <u>Fuel Type</u>  | <u>Fuel Unit</u> | <u>FY79 Consumption</u> |
|-------------------|------------------|-------------------------|
| Electricity       | kWh              | 25,019,960              |
| No. 6 Fuel Oil    | Gal.             | 3,718,470               |
| No. 2 Fuel Oil    | Gal.             | 114,576                 |
| Natural Gas       | Therm            | 12,339                  |
| Propane Gas       | Gal.             | 3,819                   |
| No. 2 Diesel Fuel | Gal.             | 36,834                  |
| Gasoline          | Gal.             | 94,248                  |

Table 2-2 below lists the energy conversion factors for the various fuels used at MOTBY. This list is consistent with the values given in Section 8 of ECIP Guidance dated 10 November 1980:

Table 2-2

#### Energy Conversion Factors

| <u>Fuel</u>       | <u>Fuel Unit</u>            | <u>Conversion Factor</u>            | <u>Conversion Factor<br/>in MBtu</u> |
|-------------------|-----------------------------|-------------------------------------|--------------------------------------|
| Electricity       | kWh                         | 11,600 Btu/kWh                      | 0.0116 MBtu/kWh                      |
| No. 6 Fuel Oil    | Gal.                        | 149,600 Btu/Gal.                    | 0.1496 MBtu/Gal.                     |
| No. 2 Fuel Oil    | Gal.                        | 138,700 Btu/Gal.                    | 0.1387 MBtu/Gal.                     |
| Natural Gas       | Therm (10 <sup>5</sup> Btu) | 1,031,000 Btu/1,000 ft <sup>3</sup> | 0.1031 MBtu/Therm                    |
| Propane           | Gal.                        | 95,500 Btu/Gal.                     | 0.0955 MBtu/Gal.                     |
| No. 2 Diesel Fuel | Gal.                        | 149,700 Btu/Gal.                    | 0.1497 MBtu/Gal.                     |
| Gasoline          | Gal.                        | 149,700 Btu/Gal.                    | 0.1497 MBtu/Gal.                     |

Table 2-3 below lists the unit energy costs for FY79 by fuel type. The origin of these costs are given in foot notes.

Table 2-3

Unit Fuel Costs: FY79

| <u>Fuel Type</u>  | <u>FY79 Average<br/>Unit Cost</u> | <u>Note</u> |
|-------------------|-----------------------------------|-------------|
| Electricity       | \$3.497/MBtu                      | 1           |
| No. 6 Fuel Oil    | \$4.115/MBtu                      | 2           |
| No. 2 Fuel Oil    | \$4.02/MBtu                       | 3           |
| Natural Gas       | \$0.3825/Therm                    | 4           |
| Propane Gas       | \$0.637/Gal.                      | 5           |
| No. 2 Diesel Fuel | \$4.35/MBtu                       | 6           |
| Gasoline          | \$0.84/Gal.                       | 7           |

<sup>1</sup> Based on 85 percent of the 1980 average value of \$0.047725/kwh.

<sup>2</sup> Based on 70 percent of the January 1982 cost of \$0.88/Gal.

<sup>3</sup> Based on 70 percent of the January 1982 cost of \$0.85/Gal.

<sup>4</sup> Based on 70 percent of the January 1982 cost of \$0.555/Therm.

<sup>5</sup> Based on 70 percent of the January 1982 cost of \$0.91/Gal.

<sup>6</sup> Based on 70 percent of the January 1982 cost of \$0.92/Gal.

<sup>7</sup> Based on 70 percent of the January 1982 cost of \$1.20/Gal.



A summary of FY79 basewide energy consumption and costs by fuel type is given below in Table 2-4:

Table 2-4

Basewide Energy Consumption by Fuel Type - FY79

| <u>Fuel Type</u>  | <u>Quantity</u> | <u>Equivalent Btu</u> | <u>Cost</u>        |
|-------------------|-----------------|-----------------------|--------------------|
| Electricity       | 25,019,360 kWh  | 290,000 MBtu          | \$1,014,000        |
| No. 6 Fuel Oil    | 3,718,470 Gal.  | 557,000 MBtu          | 2,292,000          |
| No. 2 Fuel Oil    | 114,576 Gal.    | 17,200 MBtu           | 69,144             |
| Natural Gas       | 12,339 Therms   | 1,230 MBtu            | 4,790              |
| Propane Gas       | 3,819 Gal.      | 571 MBtu              | 2,430              |
| No. 2 Diesel Fuel | 36,834 Gal.     | 5,510 MBtu            | 23,970             |
| Gasoline          | 94,248 Gal.     | 14,100 MBtu           | 79,200             |
|                   |                 | <u>865,611 MBtu</u>   | <u>\$3,485,534</u> |

Table 2-5 summarizes the FY85 unit fuel costs for each fuel. These values are used as a basis for ECM evaluations, and are based on the November 1981 fuel bills. November 1981 fuel costs are given, and then converted to a uniform \$/MBtu unit cost for November 1981 using the conversion factors stated in Table 2-2. These values are escalated to FY85 using the annual escalation rates provided in "ECIP Guidance" of 20%/yr for natural gas and propane, and 15%/yr for all other fuels.

Table 2-5

Fuel Unit Costs Used in ECM Evaluation

| <u>Fuel Type</u>  | <u>Unit Cost<br/>per Fuel Unit<br/>November 1981</u> | <u>Unit Cost<br/>November 1981</u> | <u>Unit Cost<br/>FY85</u> |
|-------------------|--|------------------------------------|---------------------------|
| Electricity       | \$0.063/kWh  | \$5.88/MBtu                        | \$7.72/MBtu               |
| No. 6 Fuel Oil    | \$0.88/Gal.  | \$5.43/MBtu                        | \$8.36/MBtu               |
| No. 2 Fuel Oil    | \$0.85/Gal.  | \$6.13/MBtu                        | \$8.71/MBtu               |
| Natural Gas       | \$0.573/100 ft <sup>3</sup>                          | \$5.56/MBtu                        | \$9.43/MBtu               |
| Propane Gas       | \$0.91/Gal.  | \$9.53/MBtu                        | \$16.00/MBtu              |
| No. 2 Diesel Fuel | \$0.88/Gal.  | \$5.88/MBtu                        | \$8.36/MBtu               |
| Gasoline          | \$1.20/Gal.  | \$8.02/MBtu                        | \$11.40/MBtu              |

## 2.2 TOTAL ANNUAL ENERGY USED

Table 2-6 below summarizes the total basewide energy use for FY75, FY79 and FY80, and also the energy costs for these years. No cost data is available for FY75.

Table 2-6

Total Annual Energy Use - FY75, FY79, and FY80

| <u>Fiscal Year</u> | <u>Annual Energy Use (MBtu/yr)</u> | <u>Annual Energy Cost (\$/yr)</u> | <u>Use as % of FY75</u> | <u>Cost as % of FY79</u> |
|--------------------|------------------------------------|-----------------------------------|-------------------------|--------------------------|
| FY75               | 979,200                            | Data Not Available                | 100%                    | ----                     |
| FY79               | 885,600                            | 3,485,534                         | 90.4%                   | 100%                     |
| FY80               | 881,100                            | 4,221,641                         | 90.0%                   | 121%                     |

As shown in this table, FY80 energy consumption was only slightly less than FY79 consumption, and both are approximately 90% of the baseline FY75 consumption. To meet the stated goal of a 20% reduction of FY75 use by FY85, an additional 10% reduction (= 97,900 MBtu/yr) is required.

## 2.3 BUILDING GROUP ENERGY CONSUMPTION

Of the 43 buildings at MOTBY and 9 buildings of the Galesborough Village family housing area, 10 were chosen for detailed analysis for the Energy Engineering Analysis Program (EEAP) under a contract with Roy F. Weston, Inc. of West Chester, Pennsylvania. These buildings were chosen as representative of others, or as unique on the facility. Building 32 was later added to this group. In a separate contract for an EMCS feasibility study, which is part of the EEAP, the firm of V. L. Falotico of New York, NY completed an energy loads survey, the results of which are given in Table 2-7 below. Underlined buildings are those surveyed by Roy F. Weston, Inc. Building loads are given in units of thousands of Btu per hour, i.e. KBtu/hr.

Table 2-7

Building Design Heating Loads - Buildings Heated by Building 44-C Heating Plant

| <u>Bldg. No.</u> | <u>Floor Area (ft<sup>2</sup>)</u> | <u>65° Areas (kBtu/hr)</u> | <u>40-55° Areas (kBtu/hr)</u> | <u>Total (kBtu/hr)</u> |
|------------------|------------------------------------|----------------------------|-------------------------------|------------------------|
| 1A               | 1,300                              | 0                          | 100                           | 100                    |

Table 2-7 - Continued

Building Design Heating Loads - Buildings Heated  
by Building 44-C Heating Plant

| <u>Bldg.<br/>No.</u> | <u>Floor Area<br/>(ft<sup>2</sup>)</u> | <u>65° Areas<br/>(kBtu/hr)</u> | <u>40-55° Areas<br/>(kBtu/hr)</u> | <u>Total<br/>(kBtu/hr)</u> |
|----------------------|--|--------------------------------|-----------------------------------|----------------------------|
| 11                   | 61,700                                 | 24                             | 1,519                             | 1,543                      |
| 12                   | 121,400                                | 65                             | 3,090                             | 3,155                      |
| 13                   | 121,400                                | 44                             | 3,111                             | 3,155                      |
| 14                   | 121,400                                | 65                             | 3,090                             | 3,155                      |
| 15A                  | 11,300                                 | 720                            | 0                                 | 720                        |
| 21/31                | 182,000                                | 82                             | 2,792                             | 2,874                      |
| 22                   | 121,400                                | 65                             | 3,090                             | 3,155                      |
| 23                   | 121,400                                | 33                             | 3,122                             | 3,155                      |
| 24                   | 121,400                                | 65                             | 3,090                             | 3,155                      |
| 32                   | 720,000                                | 227                            | 7,462                             | 7,749                      |
| 33                   | 121,400                                | 64                             | 3,091                             | 3,155                      |
| 34                   | 121,400                                | 90                             | 6,800                             | 6,890                      |
| 35                   | 94,600                                 | 347                            | 272                               | 619                        |
| 41                   | 171,200                                | 78                             | 674                               | 752                        |
| 42                   | 776,800                                | 1,325                          | 9,500                             | 10,825                     |
| 43                   | 121,400                                | 45                             | 3,110                             | 3,155                      |
| 44A                  | 22,600                                 | 270                            | 638                               | 908                        |
| 44B                  | 10,200                                 | 611                            | 450                               | 1,061                      |
| 44C                  | 9,300                                  | 44                             | 301                               | 345                        |
| 44D                  | 11,200                                 | 202                            | 640                               | 842                        |
| 45                   | 126,600                                | 619                            | 2,671                             | 3,290                      |
| 52A                  | 13,300                                 | 426                            | 0                                 | 426                        |
| 52B                  | 6,500                                  | 326                            | 0                                 | 326                        |
| 52C                  | 5,100                                  | 176                            | 0                                 | 176                        |
| 53A                  | 8,200                                  | 76                             | 582                               | 658                        |
| 54                   | 120,000                                | 39                             | 4,720                             | 4,759                      |
| 55                   | 120,000                                | 39                             | 4,720                             | 4,759                      |
| 61B                  | 4,900                                  | 482                            | 0                                 | 482                        |
| 63                   | 120,000                                | 39                             | 4,720                             | 4,759                      |
| 64                   | 120,000                                | 39                             | 4,720                             | 4,759                      |
| 72                   | 60,800                                 | 1,946                          | 0                                 | 1,946                      |
| 72A                  | 4,800                                  | 88                             | 174                               | 262                        |
| 73                   | 120,000                                | 33                             | 3,087                             | 3,120                      |
| 74                   | 120,000                                | 17                             | 3,003                             | 3,120                      |
| 82                   | 136,000                                | 4,352                          | 0                                 | 4,352                      |
| 83A                  | 6,000                                  | 531                            | 0                                 | 531                        |
| 100                  | 192,400                                | 2,499                          | 0                                 | 2,499                      |
| 101                  | 158,600                                | 5,075                          | 0                                 | 5,075                      |
| 105                  | 10,800                                 | 0                              | 535                               | 535                        |
| 108                  | 11,700                                 | 575                            | 0                                 | 575                        |
| 110                  | 3,300                                  | 288                            | 0                                 | 288                        |
| 111                  | 5,700                                  | 438                            | 0                                 | 438                        |
| Totals               | 4,638,800                              | 22,729                         | 84,874                            | 107,603                    |

## 2.4 TYPICAL BUILDING ENERGY CONSUMPTION

Buildings chosen to be surveyed were done so on the basis of being representative of others on the facility. To extrapolate the ECM projects in the surveyed buildings to those not surveyed, Table 2-8 below was prepared, in which each extrapolated building is identified with a surveyed building on the basis of building construction, occupancy, and use. For extrapolation purposes, the ratio of floor areas of the extrapolated building to the similar surveyed building was calculated. This ratio was used as a multiplier to determine 1) project cost, 2) energy savings, and 3) energy cost savings for the extrapolated building.

Table 2-8

### Building Extrapolation Factors

| <u>Surveyed Buildings</u>  |  | <u>Extrapolated Building(s)</u> |  | <u>Ratio of<br/>Floor<br/>Areas</u> |
|----------------------------|--|---------------------------------|--|-------------------------------------|
| <u>Building<br/>Number</u> | <u>Floor Area<br/>(ft<sup>2</sup>)</u> | <u>Building<br/>Number</u>      | <u>Floor Area<br/>(ft<sup>2</sup>)</u> |                                     |
| 12                         | 121,400                                | 13                              | 121,400                                | 1.0                                 |
|                            |  | 14                              | 121,400                                | 1.0                                 |
|                            |  | 23                              | 121,400                                | 1.0                                 |
|                            |  | 24                              | 121,400                                | 1.0                                 |
|                            |  | 33                              | 121,400                                | 1.0                                 |
|                            |  | 34                              | 121,400                                | 1.0                                 |
|                            |  | 73                              | 120,000                                | 0.989                               |
|                            |  | 74                              | 120,000                                | 0.989                               |
| 22                         | 121,400                                | None                            | N/A                                    | N/A                                 |
| 32                         | 776,800                                | None                            | N/A                                    | N/A                                 |
| 35                         | 94,600                                 | None                            | N/A                                    | N/A                                 |
| 41                         | 171,200                                | None                            | N/A                                    | N/A                                 |
| 42                         | 776,800                                | None                            | N/A                                    | N/A                                 |
| 43                         | 121,400                                | 45                              | 126,600                                | 1.04                                |
| 52-A                       | 13,300                                 | 52-B                            | 6,500                                  | 0.499                               |
| 64                         | 120,000                                | 54                              | 120,000                                | 1.0                                 |
|                            |  | 63                              | 120,000                                | 1.0                                 |
| 72                         | 60,800                                 | None                            | N/A                                    | N/A                                 |
| 82                         | 136,000                                | None                            | N/A                                    | N/A                                 |

Note: Building 44-B was not surveyed and is not similar to any contracted building.

## SECTION 3

### ENERGY CONSERVATION MEASURES (ECMs) DEVELOPED

#### 3.1 ECMs INVESTIGATED

Using the list of potential ECMs in Annex A of the Scope of Work, previous engineering experience, and a preliminary facility field survey, a list of potential ECMs to be investigated was developed by WESTON, Inc. To this list was later added the potential ECMs of Building 32. The final list is as shown in Figure 3-1. Not all ECMs on this list met the ECIP criteria of E/C ratio greater than 13 to be included in ECIP or Increment G projects. In the EMCS feasibility study done independently by V.L. Falotico, Inc., a similar list of ECMs related to an EMCS system was developed. (For a complete list of these ECMs refer to the "Concept Submission" dated 31 December 1980 by Falotico.)

Because of the overlap of projects in the two studies, ECM costs and savings have been grouped into 3 categories:

Category A: ECMs also identified by V.L. Falotico, Inc. for proposed EMCS.

Category B: Additional ECMs for the EMCS identified by R.F. Weston, Inc.

Category C: ECMs not related to the EMCS identified by Weston.

For ECMs in Category A, the costs and savings predicted by V.L. Falotico have been used. ECMs in Category A evaluated by Weston are indicated by a "w" on Figure 3-1.

The ECMs in Category B have been grouped into an Increment G project. These ECMs are indicated by a "B" on Figure 3-1.

The ECMs in Category C are indicated on Figure 3-1 by a "C".

These three categories are used when summarizing the costs and savings of all projects.

The results of the detailed ECM investigations are given in Table 3-1. The table is organized by buildings surveyed. Information included is:

NO. 0155-10-01  
 1955

TABLE 1-1. ENERGY CONSERVATION MEASURES INVESTIGATION

PROJECT: MILITARY BUILDING STANDARDS

NO. 0155-10-01



| S. N. | NAME OF PROJECT | MEASURES |        |        |        |        |        |        |        |        |         | GENERAL REMARKS |
|-------|-----------------|----------|--------|--------|--------|--------|--------|--------|--------|--------|---------|-----------------|
|       |                 | 1        | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10      |                 |
| 1     | 1.1             | 1.1.1    | 1.1.2  | 1.1.3  | 1.1.4  | 1.1.5  | 1.1.6  | 1.1.7  | 1.1.8  | 1.1.9  | 1.1.10  | GENERAL REMARKS |
| 2     | 2.1             | 2.1.1    | 2.1.2  | 2.1.3  | 2.1.4  | 2.1.5  | 2.1.6  | 2.1.7  | 2.1.8  | 2.1.9  | 2.1.10  |                 |
| 3     | 3.1             | 3.1.1    | 3.1.2  | 3.1.3  | 3.1.4  | 3.1.5  | 3.1.6  | 3.1.7  | 3.1.8  | 3.1.9  | 3.1.10  | GENERAL REMARKS |
| 4     | 4.1             | 4.1.1    | 4.1.2  | 4.1.3  | 4.1.4  | 4.1.5  | 4.1.6  | 4.1.7  | 4.1.8  | 4.1.9  | 4.1.10  |                 |
| 5     | 5.1             | 5.1.1    | 5.1.2  | 5.1.3  | 5.1.4  | 5.1.5  | 5.1.6  | 5.1.7  | 5.1.8  | 5.1.9  | 5.1.10  | GENERAL REMARKS |
| 6     | 6.1             | 6.1.1    | 6.1.2  | 6.1.3  | 6.1.4  | 6.1.5  | 6.1.6  | 6.1.7  | 6.1.8  | 6.1.9  | 6.1.10  |                 |
| 7     | 7.1             | 7.1.1    | 7.1.2  | 7.1.3  | 7.1.4  | 7.1.5  | 7.1.6  | 7.1.7  | 7.1.8  | 7.1.9  | 7.1.10  | GENERAL REMARKS |
| 8     | 8.1             | 8.1.1    | 8.1.2  | 8.1.3  | 8.1.4  | 8.1.5  | 8.1.6  | 8.1.7  | 8.1.8  | 8.1.9  | 8.1.10  |                 |
| 9     | 9.1             | 9.1.1    | 9.1.2  | 9.1.3  | 9.1.4  | 9.1.5  | 9.1.6  | 9.1.7  | 9.1.8  | 9.1.9  | 9.1.10  | GENERAL REMARKS |
| 10    | 10.1            | 10.1.1   | 10.1.2 | 10.1.3 | 10.1.4 | 10.1.5 | 10.1.6 | 10.1.7 | 10.1.8 | 10.1.9 | 10.1.10 |                 |
| 11    | 11.1            | 11.1.1   | 11.1.2 | 11.1.3 | 11.1.4 | 11.1.5 | 11.1.6 | 11.1.7 | 11.1.8 | 11.1.9 | 11.1.10 | GENERAL REMARKS |
| 12    | 12.1            | 12.1.1   | 12.1.2 | 12.1.3 | 12.1.4 | 12.1.5 | 12.1.6 | 12.1.7 | 12.1.8 | 12.1.9 | 12.1.10 |                 |
| 13    | 13.1            | 13.1.1   | 13.1.2 | 13.1.3 | 13.1.4 | 13.1.5 | 13.1.6 | 13.1.7 | 13.1.8 | 13.1.9 | 13.1.10 | GENERAL REMARKS |
| 14    | 14.1            | 14.1.1   | 14.1.2 | 14.1.3 | 14.1.4 | 14.1.5 | 14.1.6 | 14.1.7 | 14.1.8 | 14.1.9 | 14.1.10 |                 |
| 15    | 15.1            | 15.1.1   | 15.1.2 | 15.1.3 | 15.1.4 | 15.1.5 | 15.1.6 | 15.1.7 | 15.1.8 | 15.1.9 | 15.1.10 | GENERAL REMARKS |
| 16    | 16.1            | 16.1.1   | 16.1.2 | 16.1.3 | 16.1.4 | 16.1.5 | 16.1.6 | 16.1.7 | 16.1.8 | 16.1.9 | 16.1.10 |                 |
| 17    | 17.1            | 17.1.1   | 17.1.2 | 17.1.3 | 17.1.4 | 17.1.5 | 17.1.6 | 17.1.7 | 17.1.8 | 17.1.9 | 17.1.10 | GENERAL REMARKS |
| 18    | 18.1            | 18.1.1   | 18.1.2 | 18.1.3 | 18.1.4 | 18.1.5 | 18.1.6 | 18.1.7 | 18.1.8 | 18.1.9 | 18.1.10 |                 |
| 19    | 19.1            | 19.1.1   | 19.1.2 | 19.1.3 | 19.1.4 | 19.1.5 | 19.1.6 | 19.1.7 | 19.1.8 | 19.1.9 | 19.1.10 | GENERAL REMARKS |
| 20    | 20.1            | 20.1.1   | 20.1.2 | 20.1.3 | 20.1.4 | 20.1.5 | 20.1.6 | 20.1.7 | 20.1.8 | 20.1.9 | 20.1.10 |                 |
| 21    | 21.1            | 21.1.1   | 21.1.2 | 21.1.3 | 21.1.4 | 21.1.5 | 21.1.6 | 21.1.7 | 21.1.8 | 21.1.9 | 21.1.10 | GENERAL REMARKS |
| 22    | 22.1            | 22.1.1   | 22.1.2 | 22.1.3 | 22.1.4 | 22.1.5 | 22.1.6 | 22.1.7 | 22.1.8 | 22.1.9 | 22.1.10 |                 |
| 23    | 23.1            | 23.1.1   | 23.1.2 | 23.1.3 | 23.1.4 | 23.1.5 | 23.1.6 | 23.1.7 | 23.1.8 | 23.1.9 | 23.1.10 | GENERAL REMARKS |
| 24    | 24.1            | 24.1.1   | 24.1.2 | 24.1.3 | 24.1.4 | 24.1.5 | 24.1.6 | 24.1.7 | 24.1.8 | 24.1.9 | 24.1.10 |                 |
| 25    | 25.1            | 25.1.1   | 25.1.2 | 25.1.3 | 25.1.4 | 25.1.5 | 25.1.6 | 25.1.7 | 25.1.8 | 25.1.9 | 25.1.10 | GENERAL REMARKS |
| 26    | 26.1            | 26.1.1   | 26.1.2 | 26.1.3 | 26.1.4 | 26.1.5 | 26.1.6 | 26.1.7 | 26.1.8 | 26.1.9 | 26.1.10 |                 |
| 27    | 27.1            | 27.1.1   | 27.1.2 | 27.1.3 | 27.1.4 | 27.1.5 | 27.1.6 | 27.1.7 | 27.1.8 | 27.1.9 | 27.1.10 | GENERAL REMARKS |
| 28    | 28.1            | 28.1.1   | 28.1.2 | 28.1.3 | 28.1.4 | 28.1.5 | 28.1.6 | 28.1.7 | 28.1.8 | 28.1.9 | 28.1.10 |                 |
| 29    | 29.1            | 29.1.1   | 29.1.2 | 29.1.3 | 29.1.4 | 29.1.5 | 29.1.6 | 29.1.7 | 29.1.8 | 29.1.9 | 29.1.10 | GENERAL REMARKS |
| 30    | 30.1            | 30.1.1   | 30.1.2 | 30.1.3 | 30.1.4 | 30.1.5 | 30.1.6 | 30.1.7 | 30.1.8 | 30.1.9 | 30.1.10 |                 |
| 31    | 31.1            | 31.1.1   | 31.1.2 | 31.1.3 | 31.1.4 | 31.1.5 | 31.1.6 | 31.1.7 | 31.1.8 | 31.1.9 | 31.1.10 | GENERAL REMARKS |
| 32    | 32.1            | 32.1.1   | 32.1.2 | 32.1.3 | 32.1.4 | 32.1.5 | 32.1.6 | 32.1.7 | 32.1.8 | 32.1.9 | 32.1.10 |                 |
| 33    | 33.1            | 33.1.1   | 33.1.2 | 33.1.3 | 33.1.4 | 33.1.5 | 33.1.6 | 33.1.7 | 33.1.8 | 33.1.9 | 33.1.10 | GENERAL REMARKS |
| 34    | 34.1            | 34.1.1   | 34.1.2 | 34.1.3 | 34.1.4 | 34.1.5 | 34.1.6 | 34.1.7 | 34.1.8 | 34.1.9 | 34.1.10 |                 |
| 35    | 35.1            | 35.1.1   | 35.1.2 | 35.1.3 | 35.1.4 | 35.1.5 | 35.1.6 | 35.1.7 | 35.1.8 | 35.1.9 | 35.1.10 | GENERAL REMARKS |
| 36    | 36.1            | 36.1.1   | 36.1.2 | 36.1.3 | 36.1.4 | 36.1.5 | 36.1.6 | 36.1.7 | 36.1.8 | 36.1.9 | 36.1.10 |                 |
| 37    | 37.1            | 37.1.1   | 37.1.2 | 37.1.3 | 37.1.4 | 37.1.5 | 37.1.6 | 37.1.7 | 37.1.8 | 37.1.9 | 37.1.10 | GENERAL REMARKS |
| 38    | 38.1            | 38.1.1   | 38.1.2 | 38.1.3 | 38.1.4 | 38.1.5 | 38.1.6 | 38.1.7 | 38.1.8 | 38.1.9 | 38.1.10 |                 |
| 39    | 39.1            | 39.1.1   | 39.1.2 | 39.1.3 | 39.1.4 | 39.1.5 | 39.1.6 | 39.1.7 | 39.1.8 | 39.1.9 | 39.1.10 | GENERAL REMARKS |
| 40    | 40.1            | 40.1.1   | 40.1.2 | 40.1.3 | 40.1.4 | 40.1.5 | 40.1.6 | 40.1.7 | 40.1.8 | 40.1.9 | 40.1.10 |                 |
| 41    | 41.1            | 41.1.1   | 41.1.2 | 41.1.3 | 41.1.4 | 41.1.5 | 41.1.6 | 41.1.7 | 41.1.8 | 41.1.9 | 41.1.10 | GENERAL REMARKS |
| 42    | 42.1            | 42.1.1   | 42.1.2 | 42.1.3 | 42.1.4 | 42.1.5 | 42.1.6 | 42.1.7 | 42.1.8 | 42.1.9 | 42.1.10 |                 |
| 43    | 43.1            | 43.1.1   | 43.1.2 | 43.1.3 | 43.1.4 | 43.1.5 | 43.1.6 | 43.1.7 | 43.1.8 | 43.1.9 | 43.1.10 | GENERAL REMARKS |
| 44    | 44.1            | 44.1.1   | 44.1.2 | 44.1.3 | 44.1.4 | 44.1.5 | 44.1.6 | 44.1.7 | 44.1.8 | 44.1.9 | 44.1.10 |                 |
| 45    | 45.1            | 45.1.1   | 45.1.2 | 45.1.3 | 45.1.4 | 45.1.5 | 45.1.6 | 45.1.7 | 45.1.8 | 45.1.9 | 45.1.10 | GENERAL REMARKS |
| 46    | 46.1            | 46.1.1   | 46.1.2 | 46.1.3 | 46.1.4 | 46.1.5 | 46.1.6 | 46.1.7 | 46.1.8 | 46.1.9 | 46.1.10 |                 |
| 47    | 47.1            | 47.1.1   | 47.1.2 | 47.1.3 | 47.1.4 | 47.1.5 | 47.1.6 | 47.1.7 | 47.1.8 | 47.1.9 | 47.1.10 | GENERAL REMARKS |
| 48    | 48.1            | 48.1.1   | 48.1.2 | 48.1.3 | 48.1.4 | 48.1.5 | 48.1.6 | 48.1.7 | 48.1.8 | 48.1.9 | 48.1.10 |                 |
| 49    | 49.1            | 49.1.1   | 49.1.2 | 49.1.3 | 49.1.4 | 49.1.5 | 49.1.6 | 49.1.7 | 49.1.8 | 49.1.9 | 49.1.10 | GENERAL REMARKS |
| 50    | 50.1            | 50.1.1   | 50.1.2 | 50.1.3 | 50.1.4 | 50.1.5 | 50.1.6 | 50.1.7 | 50.1.8 | 50.1.9 | 50.1.10 |                 |
| 51    | 51.1            | 51.1.1   | 51.1.2 | 51.1.3 | 51.1.4 | 51.1.5 | 51.1.6 | 51.1.7 | 51.1.8 | 51.1.9 | 51.1.10 | GENERAL REMARKS |
| 52    | 52.1            | 52.1.1   | 52.1.2 | 52.1.3 | 52.1.4 | 52.1.5 | 52.1.6 | 52.1.7 | 52.1.8 | 52.1.9 | 52.1.10 |                 |
| 53    | 53.1            | 53.1.1   | 53.1.2 | 53.1.3 | 53.1.4 | 53.1.5 | 53.1.6 | 53.1.7 | 53.1.8 | 53.1.9 | 53.1.10 | GENERAL REMARKS |
| 54    | 54.1            | 54.1.1   | 54.1.2 | 54.1.3 | 54.1.4 | 54.1.5 | 54.1.6 | 54.1.7 | 54.1.8 | 54.1.9 | 54.1.10 |                 |
| 55    | 55.1            | 55.1.1   | 55.1.2 | 55.1.3 | 55.1.4 | 55.1.5 | 55.1.6 | 55.1.7 | 55.1.8 | 55.1.9 | 55.1.10 | GENERAL REMARKS |
| 56    | 56.1            | 56.1.1   | 56.1.2 | 56.1.3 | 56.1.4 | 56.1.5 | 56.1.6 | 56.1.7 | 56.1.8 | 56.1.9 | 56.1.10 |                 |
| 57    | 57.1            | 57.1.1   | 57.1.2 | 57.1.3 | 57.1.4 | 57.1.5 | 57.1.6 | 57.1.7 | 57.1.8 | 57.1.9 | 57.1.10 | GENERAL REMARKS |
| 58    | 58.1            | 58.1.1   | 58.1.2 | 58.1.3 | 58.1.4 | 58.1.5 | 58.1.6 | 58.1.7 | 58.1.8 | 58.1.9 | 58.1.10 |                 |
| 59    | 59.1            | 59.1.1   | 59.1.2 | 59.1.3 | 59.1.4 | 59.1.5 | 59.1.6 | 59.1.7 | 59.1.8 | 59.1.9 | 59.1.10 | GENERAL REMARKS |
| 60    | 60.1            | 60.1.1   | 60.1.2 | 60.1.3 | 60.1.4 | 60.1.5 | 60.1.6 | 60.1.7 | 60.1.8 | 60.1.9 | 60.1.10 |                 |
| 61    | 61.1            | 61.1.1   | 61.1.2 | 61.1.3 | 61.1.4 | 61.1.5 | 61.1.6 | 61.1.7 | 61.1.8 | 61.1.9 | 61.1.10 | GENERAL REMARKS |
| 62    | 62.1            | 62.1.1   | 62.1.2 | 62.1.3 | 62.1.4 | 62.1.5 | 62.1.6 | 62.1.7 | 62.1.8 | 62.1.9 | 62.1.10 |                 |
| 63    | 63.1            | 63.1.1   | 63.1.2 | 63.1.3 | 63.1.4 | 63.1.5 | 63.1.6 | 63.1.7 | 63.1.8 | 63.1.9 | 63.1.10 | GENERAL REMARKS |
| 64    | 64.1            | 64.1.1   | 64.1.2 | 64.1.3 | 64.1.4 | 64.1.5 | 64.1.6 | 64.1.7 | 64.1.8 | 64.1.9 | 64.1.10 |                 |
| 65    | 65.1            | 65.1.1   | 65.1.2 | 65.1.3 | 65.1.4 | 65.1.5 | 65.1.6 | 65.1.7 | 65.1.8 | 65.1.9 | 65.1.10 | GENERAL REMARKS |
| 66    | 66.1            | 66.1.1   | 66.1.2 | 66.1.3 | 66.1.4 | 66.1.5 | 66.1.6 | 66.1.7 | 66.1.8 | 66.1.9 | 66.1.10 |                 |
| 67    | 67.1            | 67.1.1   | 67.1.2 | 67.1.3 | 67.1.4 | 67.1.5 | 67.1.6 | 67.1.7 | 67.1.8 | 67.1.9 | 67.1.10 | GENERAL REMARKS |
| 68    | 68.1            | 68.1.1   | 68.1.2 | 68.1.3 | 68.1.4 | 68.1.5 | 68.1.6 | 68.1.7 | 68.1.8 | 68.1.9 | 68.1.10 |                 |
| 69    | 69.1            | 69.1.1   | 69.1.2 | 69.1.3 | 69.1.4 | 69.1.5 | 69.1.6 | 69.1.7 | 69.1.8 | 69.1.9 | 69.1.10 | GENERAL REMARKS |
| 70    | 70.1            | 70.1.1   | 70.1.2 | 70.1.3 | 70.1.4 | 70.1.5 | 70.1.6 | 70.1.7 | 70.1.8 | 70.1.9 | 70.1.10 |                 |
| 71    | 71.1            | 71.1.1   | 71.1.2 | 71.1.3 | 71.1.4 | 71.1.5 | 71.1.6 | 71.1.7 | 71.1.8 | 71.1.9 | 71.1.10 | GENERAL REMARKS |
| 72    | 72.1            | 72.1.1   | 72.1.2 | 72.1.3 | 72.1.4 | 72.1.5 | 72.1.6 | 72.1.7 | 72.1.8 | 72.1.9 | 72.1.10 |                 |
| 73    | 73.1            | 73.1.1   | 73.1.2 | 73.1.3 | 73.1.4 | 73.1.5 | 73.1.6 | 73.1.7 | 73.1.8 | 73.1.9 | 73.1.10 | GENERAL REMARKS |
| 74    | 74.1            | 74.1.1   | 74.1.2 | 74.1.3 | 74.1.4 | 74.1.5 | 74.1.6 | 74.1.7 | 74.1.8 | 74.1.9 | 74.1.10 |                 |
| 75    | 75.1            | 75.1.1   | 75.1.2 | 75.1.3 | 75.1.4 | 75.1.5 | 75.1.6 | 75.1.7 | 75.1.8 | 75.1.9 | 75.1.10 | GENERAL REMARKS |
| 76    | 76.1            | 76.1.1   | 76.1.2 | 76.1.3 | 76.1.4 | 76.1.5 | 76.1.6 | 76.1.7 | 76.1.8 | 76.1.9 | 76.1.10 |                 |
| 77    | 77.1            | 77.1.1   | 77.1.2 | 77.1.3 | 77.1.4 | 77.1.5 | 77.1.6 | 77.1.7 | 77.1.8 | 77.1.9 | 77.1.10 | GENERAL REMARKS |
| 78    | 78.1            | 78.1.1   | 78.1.2 | 78.1.3 | 78.1.4 | 78.1.5 | 78.1.6 | 78.1.7 | 78.1.8 | 78.1.9 | 78.1.10 |                 |
| 79    | 79.1            | 79.1.1   | 79.1.2 | 79.1.3 | 79.1.4 | 79.1.5 | 79.1.6 | 79.1.7 | 79.1.8 | 79.1.9 | 79.1.10 | GENERAL REMARKS |
| 80    | 80.1            | 80.1.1   | 80.1.2 | 80.1.3 | 80.1.4 | 80.1.5 | 80.1.6 | 80.1.7 | 80.1.8 | 80.1.9 | 80.1.10 |                 |
| 81    | 81.1            | 81.1.1   | 81.1.2 | 81.1.3 | 81.1.4 | 81.1.5 | 81.1.6 | 81.1.7 | 81.1.8 | 81.1.9 | 81.1.10 | GENERAL REMARKS |
| 82    | 82.1            | 82.1.1   | 82.1.2 | 82.1.3 | 82.1.4 | 82.1.5 | 82.1.6 | 82.1.7 |        |        |         |                 |

PROJECT NUMBER BEING ISSUED

10-11-54

NUMBER OF SHEETS

WESTERN

ENGINEERS

CHAS. H. WEST

GENERAL REMARKS

<

1. Project cost
2. Annual Source Energy Savings (MStu)
3. Annual Energy Cost Savings
4. Simple payback
5. B/C ratio
6. E/C ratio

From this list of potential projects only those with an E/C ratio greater than 13 were considered for implementation as ECIP and Increment G projects. Projects which were also included in the EMCS study by V.L. Falotico, Inc. were considered part of that project, and the overall costs and savings for the EMCS then apply for that particular ECM.

### 3.2 ECIP PROJECTS DEVELOPED

A summary of the ECIP projects developed is given in Table 3-2 from the individual ECMs. The EMCS study is the basis for one ECIP project. The individual ECMs not related to the EMCS (indicated by a "e" in Figure 3-1), and with an E/C ratio greater than 13 "are grouped together to form 6 ECIP Projects (A-1 thru A-6)". Each ECIP project preferably has a cost of \$200,000 or more.

For more detailed information on each project, including surveyed and extrapolated buildings, refer to the DD form 1391's in Volume IV in this report.

Note that if all seven ECIP projects are implemented, the annual energy savings is 171,159 MStu, and the annual energy cost savings in FY85 dollars is \$1,207,340. This energy savings represents 17.5% of the base year FY75 energy consumption of 979,200 MStu. The total cost of these projects is \$4,507,000.

### 3.3 OTHER ENERGY CONSERVATION PROJECTS

A summary of these projects is given in Table 3-3. These projects consist of 1) Increment G projects, in which the E/C ratio for each is greater than 13, but which do not meet the \$200,000 minimum criteria; 2) parts of the ECIP projects as requested by "MOTBY Facility Engineering; 3) a project from Increment F, and 4) the additional ECMs for the EMCS identified by WESTON.

Because of category 2) some duplication of costs and savings occur. The numbers in parentheses give the total projects cost and savings including duplication with the ECIP projects. The numbers not in parentheses give the additional cost and savings not duplicated. These values are the ones used for summarizing costs and savings. These projects will produce an additional annual energy savings of 3,055 MStu and an additional energy cost savings in FY85 dollars of \$24,230.

The additional energy savings represents 0.3% of the base year FY75 energy consumption of 979,200 MStu. The additional cost of these projects is \$103,310.

Table 3-1 (Sheet 1 of 5)

Results of Detailed  
Energy Conservation Measure Investigations

| Side<br>No. | Energy Conservation Measure               | Investment<br>\$ | Source<br>Energy<br>Payback<br>Rate | Annual<br>Savings<br>\$ | Simple<br>Payback<br>Yrs | R/C<br>Ratio | R/C<br>Ratio |
|-------------|---|------------------|-------------------------------------|-------------------------|--------------------------|--------------|--------------|
| 12          | Occupied/unoccupied control<br>(retrofit) | 7,370            | 3.376                               | 46,300                  | 0.2                      | 94.3         | 791.7        |
|             | Reheat/ventilation                        | 57,110           | 2,604                               | 21,890                  | 2.5                      | 9.7          | 40.0         |
|             | Convert to RPS fixtures                   | 19,510           | 206                                 | 1,590                   | 9.3                      | 2.3          | 14           |
|             | Insulation -- wall                        | 100,700          | 1,126                               | 9,410                   | 19.1                     | 1.2          | 6.3          |
|             | Insulation -- roof                        | 463,900          | 3,045.0                             | 42,130                  | 10.0                     | 1.9          | 11.9         |
|             | Pay -- weatherstripping                   | 1,470            | 67.0                                | 530                     | 2.5                      | 9.3          | 40.5         |
| 22          | Monitor cycle/enthalpy<br>control         | 7,200            | 134                                 | 1,030                   | 6.6                      | 2.0          | 19.6         |
|             | Occupied/unoccupied control<br>(retrofit) | 9,070            | 3,045                               | 42,170                  | 0.20                     | 71.7         | 692.0        |
|             | Reheat/ventilation                        | 3,410            | 150.0                               | 1,100                   | 2.0                      | 5.0          | 40.2         |
|             | Insulation switching                      | 6,520            | 199                                 | 6,510                   | 4.1                      | 5.0          | 32.1         |
|             | Optimized start/stop                      | 4,790            | 149.3                               | 1,200                   | 3.0                      | 3.6          | 32.3         |
|             | Convert to RPS fixtures                   | 17,450           | 165                                 | 1,270                   | 10.1                     | 2.1          | 12.9         |
|             | Insulation -- wall                        | 137,180          | 938                                 | 7,810                   | 19.0                     | 1.2          | 6.3          |
|             | Insulation -- roof                        | 443,800          | 4,951.1                             | 41,700                  | 10.7                     | 1.9          | 11.7         |
|             | Pay -- weatherstripping                   | 1,450            | 123.1                               | 1,030                   | 1.3                      | 17.0         | 89.2         |
|             | Insulate skylights                        | 62,720           | 510.0                               | 6,270                   | 10.0                     | 1.7          | 8.6          |
|             | Insulate office ceiling                   | 11,130           | 161.6                               | 1,330                   | 7.0                      | 3.0          | 35.3         |
|             | Heat recovery from condensation           | 1,910            | 2.0                                 | 20                      | 90.5                     | 0.2          | 1.5          |
| 35          | Occupied/unoccupied control<br>(retrofit) | 7,370            | 60.3                                | 530                     | 12.2                     | 1.2          | 9.0          |
|             | Reheat/ventilation                        | 1,700            | 5.0                                 | 40                      | 40.5                     | 0.3          | 1.1          |
|             | Convert to RPS fixtures                   | 10,300           | 320.0                               | 4,000                   | 2.4                      | 4.0          | 30.6         |
|             | Insulation -- wall                        | 51,760           | 2,021.0                             | 21,700                  | 2.3                      | 9.4          | 57.4         |
|             | Insulation -- roof                        | 328,070          | 181.9                               | 1,410                   | 231.1                    | 0.1          | 0.6          |
|             | Heat recovery from condensation           | 33,660           | 213.1                               | 2,040                   | 17.5                     | 0.9          | 6.0          |





Table 3-1 (Sheet 3 of 5)

| Study<br>No. | Energy Conservation Measure  | Investment<br>\$  | Source<br>Energy<br>Savings<br>\$/yr                                  | Simple<br>Payback<br>yrs  | O/C<br>Ratio   | E/C<br>Ratio   |
|--------------|--|---|---|---|--|--|
| 47           | Isolation switching<br>Insulation -- wall<br>Insulation -- roof<br>Doors -- weatherstrip<br>Daylights or translucent<br>wall panels<br>A/C controls<br>Heat recovery from exhaust<br>air<br>Flexible doorway seals | 0,300<br>275,050<br>461,770<br>900<br>116,900<br>48,000<br>600<br>30,300    | 202<br>1,420<br>3,966.3<br>110.0<br>396.9<br>659<br>1.0<br>408.1      | 4.3<br>27.1<br>16.9<br>1.0<br>42.5<br>19.4<br>76.0<br>16.6        | 4.9<br>1.1<br>1.1<br>23.5<br>0.5<br>1.48<br>0.38<br>1.48 | 30.6<br>5.4<br>7.1<br>110.3<br>3.0<br>10.8<br>1.30<br>7.30                                       |
| 52-A         | Transmitter cycle/enthalpy<br>control<br>Occupied/unoccupied control<br>(auto-back)<br>Duty cycling<br>Optimized start/stop<br>Push/pull handle<br>Insulation -- wall<br>Insulation -- roof                        | 3,500<br>1,020<br>3,410<br>4,710<br>20,050<br>32,170<br>45,540              | 141<br>490<br>51<br>44.4<br>1,299.9<br>407<br>419.5                   | 1.090<br>3.600<br>0.3<br>0.3<br>13.4<br>1.4<br>12.4               | 4.3<br>52.9<br>1.6<br>1.6<br>12.8<br>1.5<br>1.5          | 41.3<br>402.6<br>15.7<br>9.7<br>88.2<br>3.5<br>9.7   |
| 60           | Occupied/unoccupied control<br>(auto-back)<br>Deaerification<br>Infrared heating<br>Isolation switching<br>Insulation -- wall<br>Insulation -- roof<br>Doors -- weatherstrip<br>Daylights or translucent<br>panels | 7,350<br>57,110<br>3,537.0<br>28,300<br>35,960<br>410,910<br>920<br>114,900 | 6,459<br>3,537.0<br>29,520<br>740<br>6,290<br>3,973.7<br>103.1<br>397 | 37,200<br>29,520<br>1.0<br>4.0<br>33,500<br>20,860<br>1.0<br>42.5 | 0.2<br>1.0<br>12.9<br>4.1<br>0.4<br>13.7<br>1.0<br>0.3   | 630.9<br>65.0<br>more energy consumed than existing system<br>4.1<br>104.1<br>1.2<br>33.3<br>3.0 |
| 72           | Transmitter cycle/enthalpy<br>control<br>Heat discharge air temper-<br>ature<br>Convert to chilled water<br>system (Rdop. 72 and 97)<br>Occupied/unoccupied control<br>(auto-back)                                 | 10,700<br>5,500<br>307,190<br>10,700  | 160<br>775<br>8,845<br>2,701.2  | 1,230<br>5,900<br>60,200<br>22,500                                | 0.3<br>0.9<br>4.3<br>0.6                                 | 1.6<br>15.1<br>5.0<br>23   |

Table 3-1 (Sheet 4 of 5)

| Iden-<br>no.                 | Energy Conservation Measure  | Investment<br>\$  | Source<br>Energy<br>Savings<br>Rate   | Annual<br>Savings<br>\$   | Simple<br>Payback<br>Yrs   | B/C<br>Ratio   | B/C<br>Ratio   |
|------------------------------|--|---|---|---|--|--|--|
| 72                           | Battery cycling<br>Conversion to VHF<br>Insulation<br>Convert to BPH fixtures<br>Insulation -- wall<br>Insulation -- roof<br>Solar film<br>Heat recovery from condensa-<br>tion<br>Flow restrictors  | 0,550<br>85,100<br>4,800<br>15,300<br>275,000<br>180,300<br>17,950  | 157<br>1,313<br>546.6<br>312<br>2,243<br>1,224.5<br>46.2  | 1,320<br>10,130<br>4,370<br>2,560<br>10,750<br>10,200<br>310  | 9.3<br>0.6<br>1.0<br>5.7<br>11.5<br>16.7<br>55.1   | 2.9<br>16.2<br>23.3<br>3.2<br>2.1<br>1.4<br>0.3  | 34.2<br>1.7<br>110.1<br>22.7<br>10.4<br>7.1<br>2.6   |
| 82                           | Thermostat cycling/enthalpy<br>control<br>Heat discharge air tempera-<br>ture<br>Convert to chilled water<br>system (Bldgs. 71 and 22)<br>Occupied/unoccupied con-<br>trol (toothbrush)<br>Battery cycling<br>Optimized start/stop<br>Push/pull heads<br>Conversion to VHF<br>Insulation switching<br>Automatic light level<br>control<br>Insulation -- wall<br>Insulation -- roof<br>Solar film<br>Heat recovery from condensa-<br>tion<br>Flow restrictors | 1,000<br>820<br>3,500<br>1,110<br>7,250<br>66,510<br>5,470<br>6,500<br>12,500<br>6,500<br>29,550<br>40,310<br>200,200<br>33,300<br>5,600<br>820 | 70.4<br>76.0<br>74.7<br>213<br>9,401.0<br>40.0<br>50.9<br>120.6<br>312.4<br>145<br>231.1<br>4,254<br>2,017.2<br>95.3<br>203.3<br>76.0 | 670<br>600<br>500<br>1,050<br>75,270<br>310<br>390<br>1,040<br>2,018<br>1,050<br>1,900<br>16,020<br>16,000<br>710<br>1,700<br>600 | 2.7<br>1.2<br>5.9<br>0.6<br>0.10<br>136.5<br>13.3<br>6.0<br>5.0<br>3.9<br>14.5<br>11.5<br>16.0<br>44.7<br>3.2<br>1.2 | 3.3<br>11.7<br>2.3<br>20.0<br>154.9<br>0.10<br>1.0<br>3.0<br>2.2<br>5.1<br>0.9<br>2.1<br>1.1<br>0.6<br>4.5<br>11.7 | 44.7<br>98.5<br>21.9<br>201.2<br>1,301.1<br>0.90<br>9.8<br>20.7<br>16.2<br>34<br>0.9<br>10.4<br>7.1<br>3.0<br>37.9<br>98.5 |
| Other-<br>borough<br>village | Occupied/unoccupied con-<br>trol (toothbrush)<br>Insulation -- wall<br>Insulation -- roof<br>Flow restrictors  | 79,400<br>600,100<br>100,470<br>0,000   | 3,540.0<br>5,776<br>4,574.6<br>1,200.0  | 29,600<br>48,250<br>10,200<br>10,030  | 0.90<br>13.4<br>4.5<br>0.6   | 15.1<br>1.0<br>4.2<br>25.1   | 126.0<br>8.9<br>26.7<br>210.5  |

See Building 72.



| Line<br>No. | Project                                     | Amount Balance<br>energy savings<br>(million \$/yr) | Amount Savings<br>total savings<br>(million \$/yr) | Project Cash<br>Added (net Invest. Required)<br>(1) | Simple<br>Payback<br>(yr) | NPV<br>Ratio | NPV<br>Ratio<br>(multiplied by 1) | IRR                |
|-------------|---|---|--|---|---------------------------|--------------|-----------------------------------|--------------------|
| 0.1         | Small Communities -<br>Bridgewater Village  | 0.579, 0  | 10.240   | 197,271   | 5.2                       | 1.1          | 21.1                              | 0.40               |
| 0.2         | Rehabilitate of System No. 1                | 0.077 0   | 64,261   | 345,340   | 3.3                       | 5.2          | 10.6                              | 5.71               |
| 0.3         | Conservation of Properties                  | 27,547 0  | 102,540  | 0.00, 190   | 2.5                       | 0.5          | 07.2                              | 0.40               |
| 0.4         | System Investigation                        | 00, 000 0   | 300,071  | 705,000   | 2.1                       | 11.6         | 16.0                              | 12.16              |
| 0.5         | Transfer to Central Cooling<br>water System | 0.000, 0  | 68,200   | 666,600   | 3.6                       | 5.5          | 10.5                              | 7.20               |
| 0.6         | Installation of Heat Recovery System        | 310,731.2   | 272,731  | 710,700   | 0.6                       | 0.5          | 10.0                              | 9.36               |
| -           | Subtotal = 6. Subsystem, Item 1             | 51,000 6  | 400,500  | 1,200,000   | 5.6                       | 3.1          | 01.6                              | 000<br>Calculation |
| 1.000       |   | 171,150 0   | 0,207,300  | 0,507,130   | 3.7                       | 6.5          | 10.6                              |                    |

[illegible]

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### 3.4 POLICY CHANGES/RECOMMENDATIONS

During the site visits, the Facility Engineering personnel were interviewed to develop an overview of the energy conservation policies in effect and their effectiveness in reducing energy consumption.

The results of these interviews, coupled with observations of equipment and systems, resulted in the following list of recommended policy changes:

1. The recordkeeping feature of the proposed EMCS should greatly enhance implementation of the preventative maintenance program. It is recommended that this feature of the EMCS be efficiently utilized.
2. Revision of the material and supply stock policy. This is discussed in detail in the Increment F Report, Section 5.2, and entails the implementation of a "cash reserve" to reduce an extensive inventory of spare parts.
3. Additional vehicles be provided for maintenance personnel in order to reduce waiting time between jobs. This is also discussed in detail in the Increment F Report, Section 5.2.

## SECTION 4

### ENERGY AND COST SAVINGS

#### 4.1 BASEWIDE CONSUMPTION BEFORE ENERGY CONSERVATION PROJECTS

The following information on MDTBY basewide consumption is taken from Table 2-6:

| <u>Fiscal Year</u> | <u>Total Basewide Energy Consumption (MBtu/yr)</u> | <u>% Reduction as % of FY75 Consumption</u> |
|--------------------|--|---|
| FY75               | 979,200  | -   |
| FY79               | 885,611  | 9.6%  |
| FY80               | 883,136  | 9.8%  |

#### 4.2 ALLOCATION OF ENERGY CONSERVATION PROJECT SAVINGS

The energy savings of the EEAP projects are as follows. Information is summarized from Tables 3-3 and 3-4:

| <u>Source of Savings:</u>      | <u>Annual Energy Savings (MBtu/yr)</u> | <u>% of FY75 Consumption (= 979,200 MBtu/yr)</u> |
|--------------------------------|--|--|
| <u>1. Increments A&amp;B</u>   |  |  |
| ECIP Projects A-1 thru A-6     | 117,469.0                              | 12.0%  |
| EMCS Project                   | 53,590.0                               | 5.5%   |
| <u>Subtotal</u>                | <u>171,059.0</u>                       | <u>17.5%</u>                                     |
| <u>2. Increment G</u>          |  |  |
| Additions to EMCS              | 2,850.6                                | 0.3%   |
| Projects B-1 thru B-6          | 203.3                                  | 0.02%  |
| <u>Subtotal</u>                | <u>3,053.9</u>                         | <u>0.3%</u>                                      |
| <u>3. Increment F</u>          |  |  |
| All projects                   | 19,397.0                               | 2.0%   |
| <u>TOTAL ALL EEAP PROJECTS</u> |  |  |
| Increments A, B, G, & F        | 193,609.9                              | 19.8%  |



#### 4.3 PROJECTED ENERGY CONSUMPTION

With the implementation of all proposed EEAP projects, the projected FY85 basewide energy consumption is calculated as follows:

|                             |                        |
|-----------------------------|------------------------|
| FY80 Consumption:           | 883,136 MBtu/yr        |
| Total EEAP Project Savings: | <u>193,610 MBtu/yr</u> |
| Projected FY85 Consumption: | 689,526 MBtu/yr        |

When compared to the baseline FY75 consumption of 979,200 MBtu/yr, this represents a reduction of 289,674 MBtu/yr, or 29.6%.

#### 4.4 BASEWIDE ENERGY COSTS BEFORE ENERGY CONSERVATION PROJECTS

The earliest year for which basewide energy cost information is available is FY79. The energy cost in FY79, from Table 2-4 was \$3,485,534.

#### 4.5 ALLOCATION OF ENERGY COST SAVINGS

The energy cost savings of the EEAP projects are as follows:

| <u>Source of Savings</u>       | <u>FY85<br/>Annual<br/>Energy<br/>Cost Savings<br/>(\$/yr)</u> |
|--------------------------------|--|
| 1. <u>Increment A&amp;B</u>    |  |
| ECIP Projects A-1 thru A-6     | \$ 976,754   |
| EMCS Project                   | <u>230,586</u>   |
| Subtotal                       | \$1,207,340  |
| 2. <u>Increment G</u>          |  |
| Additions to EMCS              | \$ 22,620  |
| Projects B-1 thru B-6          | <u>\$ 1,610</u>  |
| Subtotal                       | \$ 24,230  |
| 3. <u>Increment F</u>          |  |
| All projects                   | \$ 162,110   |
| <u>TOTAL ALL EEAP PROJECTS</u> | <u>\$1,393,680</u>   |

#### 4.6 PROJECTED ENERGY COSTS

The FY79 energy costs were \$3,485,000. The energy cost savings calculated above were escalated to FY85. To determine the projected FY85 costs, the FY79 energy costs must also be escalated to FY85. Using the Annual Fuel Escalation Rates from "ECIP Guidance" p.8-1.

| <u>Escalation Year</u> | <u>Escalation Rate</u> | <u>Escalation Factor</u> |
|------------------------|------------------------|--------------------------|
| FY80                   | 15%                    | 1.15                     |
| FY81                   | 15%                    | 1.15                     |
| FY82                   | 15%                    | 1.15                     |
| FY83                   | 15%                    | 1.15                     |
| FY84                   | 15%                    | 1.15                     |

TOTAL ESCALATION FACTOR is  $(1.15)^5 = 2.011$  giving the escalated FY79 fuel cost to be  $3,485,000 \times 2.011 = \$7,008,000$ .

The projected FY85 energy cost is therefore:

- = Energy Cost Escalated to FY85 - energy cost savings.
- = \$7,008,000 - \$1,393,680
- = \$5,614,320

Based on FY79 this energy cost savings represents a reduction of 19.9%.

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## SECTION 5

### INCREMENT "F" - FACILITIES ENGINEER CONSERVATION MEASURES

#### 5.1 SCOPE

The scope of this Increment is to 1) summarize the savings from Increments A, B, and C and 2) make recommendations for changes in operational and maintenance procedures falling under the responsibility of Facility Engineering.

#### 5.2 RESULTS AND RECOMMENDATIONS

The Increment F study has been issued as an independent report, dated January 1983, by R.F. WESTON, INC. One ECM was proposed which entailed O&M changes to buildings 12,22,35,41,42,43,52-A,64,72,82 Goldsborough Village and extrapolated buildings. The results of this ECM are summarized in Table 5-24 of the Increment F report: The project cost is \$95,192, and would produce an annual energy savings of 19,397 MBtu/yr and an annual energy cost savings of \$162,111. The E/C ratio of this project is 203.8.

## SECTION 6

### ENERGY PLAN

#### 6.1 MATRIX OF ENERGY SAVINGS

The ECM's investigated were combined to produce six ECIP projects: A-1 through A-6. These projects along with the EMCS project as analyzed by V. L. Falotico, Inc. are prioritized in Table 6-1 according to decreasing E/C ratio. The percent energy consumption reduction is also calculated in the last column. Totals for all ECIP projects are given at the bottom.

Table 6-2 gives similar information for Increment G projects and the Increment F project. Because of the overlap of some of the Increment G projects with the ECIP projects, two values for the Annual Energy Savings and for the project costs are given. The first value refers to the parts of the project not included in the ECIP projects. The second value (in parentheses) represents the value for the entire project including duplication with ECIP projects. When totals are calculated, the values for the parts not in the ECIP projects are used.

The ECIP projects are independent of each other and may be implemented concurrently or in any sequence. If implemented sequentially, the order of implementation should be by E/C ratio as in Table 6-1 for most effective energy savings; or by SIR for most effective cost savings. The ordering is the same in the case of these projects.

TABLE 6-1

## PRIORITIZATION OF ECIP PROJECTS

| ECIP<br>Project<br>Number | Project Name   | Project Cost<br>(FY84 - Not<br>Incl. Design)<br>(\$) | Annual Source<br>Energy Savings<br>(MBtu/yr) | B/C<br>Ratio | SIR               | R/C<br>Ratio<br>(MBtu/k\$) | Percent<br>Consump.<br>Reduction<br>(Base FY75) |
|---------------------------|--|--|--|--------------|-------------------|----------------------------|---|
| A-4                       | De-stratification  | 755,850  | 42,926.8                                     | 11.4         | 12.56             | 56.8                       | 4.42  |
| A-3                       | Electrical Projects  | 474,110  | 22,417.4                                     | 8.5          | 9.49              | 47.7                       | 2.52  |
| A-6                       | Insulation & Weatherstripping                              | 775,780  | 33,233.7                                     | 8.5          | 9.34              | 47.8                       | 3.42  |
| -                         | ENG (by V. L. Falutico, Inc.)                              | 1,290,695  | 51,690.0                                     | 3.1          | Not<br>Calculated | 41.6                       | 5.52  |
| A-5                       | Convert to Central Chilled<br>Water System - Bldg. 77 & R2 | 866,470  | 9,845.0                                      | 5.5          | 7.70              | 38.5                       | 0.92  |
| A-2                       | Mechanical System Modifications                            | 146,360  | 5,472.0                                      | 5.2          | 5.72              | 37.4                       | 0.62  |
| A-1                       | Roof Insulation<br>Goldborough Village                     | 197,871  | 4,571.6                                      | 3.7          | 4.10              | 23.1                       | 0.52  |
| Total                     |  | 4,507,136  | 171,159.0                                    | 6.5          | -----             | 38.4                       | 17.7%   |

TABLE 6-2

## PRIORITIZATION OF INCREMENT G PROJECTS

| Increment G<br>Project<br>Number | Project Name   | Annual Source<br>Energy Savings<br>(MBtu/yr) | Project Cost<br>(FY84 - Not<br>Incl. Design)<br>(\$) | B/C<br>Ratio | E/C<br>Ratio<br>(MBtu/\$) | Percent<br>Consump.<br>Reduction<br>(Base FY75) |
|----------------------------------|--|--|--|--------------|---------------------------|---|
| B-2                              | Duty Cycling - Bldg. 42                                | 0  | (1,338.0)  | 7.6          | 68.6                      | 0   |
| B-1                              | Push/Pull Windows - Duty<br>Cycling Bldg. 52A          | 0  | (1,351.0)  | 11.1         | 60.6                      | 0   |
| B-3                              | Outdoor Air Cooling                                    | 0  | (528.0)  | 4.0          | 38.6                      | 0   |
| B-5                              | HVAC Mtds. - Bldg. 82                                  | 0  | (803.9)  | 3.9          | 35.0                      | 0   |
|                                  | Additions to EMCS                                      | 7,850.6                                      | 93,060   | 3.5          | 30.6                      | 0.32  |
| B-4                              | Comminizer Cycle and Heat<br>Recovery - Bldgs. 22 & 82 | 263.3  | (412.0)  | 2.9          | 25.0                      | 0.022   |
| B-6                              | Comminizer Cycle and<br>Duty Cycling                   | 0  | (353.6)  | 2.0          | 18.4                      | 0   |
|                                  | Sub-Total  | 3,053.9                                      | 103,310  | 3.1          | 30.9                      | 0.32  |
| Increment F                      | Operation & Maintenance<br>Projects                    | 95,192.0                                     | 19,397   |              | 203.8                     | 9.72  |

Projects B-1, B-2, B-4, B-5, and B-6 are all or partially included in an ECIP project proposed in Table 3-3. The numbers in parentheses are the actual project savings and costs and include duplication with ECIP projects. The numbers not in parentheses represent portions of the project not accounted for in other projects, and are the values used for determining totals.

Project B-3 is included in the Additions to EMCS.

## 6.2 PERCENT REDUCTIONS BY 1985

Table 6-3 summarizes the reductions using data from Tables 3-3 and 3-4 and from Section 4.

TABLE 6-3

### PERCENT ENERGY REDUCTION AND CONSUMPTION FOR FY75, FY79, FY80, AND FY85

| <u>Fiscal Year</u>                 | <u>Percent<br/>Reduction<br/>Base FY75</u> | <u>Percent<br/>of FY75<br/>Consumption</u> |
|------------------------------------|--|--|
| Base Year FY75                     | 0%   | 100.0%                                     |
| FY79                               | 9.6%                                       | 90.4%                                      |
| FY80                               | 9.8%                                       | 90.2%                                      |
| ECIP Projects (Incr. A & B)        | 17.5%                                      |  |
| Increment G Projects               | 0.3%                                       |  |
| Increment F Projects               | 2.0%                                       |  |
|                                    | <u>19.8%</u>                               |  |
| FY85 With All Projects Implemented | 29.6%                                      | 70.4%                                      |

The 29.6% reduction is in excess of the 20% required, this provides the option of choosing selected projects to meet the 20% reduction requirement, or to implement them all to provide maximum savings.

### 6.3 ENERGY USAGE PER SQUARE FOOT BY 1985

The total floor area, in square feet, of the 43 buildings connected to the Building 44-C Heating Plant as given in Table 2-7 is 4,638,800 ft<sup>2</sup>. The floor area of the four building groups comprising Goldsborough Village is 52,700 ft<sup>2</sup>. This gives a total floor area of 4,691,500 ft<sup>2</sup>.

Table 6-4 gives projected basewide energy usage per square foot of building floor area. These values were obtained by dividing the basewide annual energy consumption values given in Section 4 by the total building floor area.

TABLE 6-4

#### ANNUAL BASEWIDE ENERGY CONSUMPTION PER SQUARE FOOT OF BUILDING FLOOR AREA

|                                 | <u>MStu/yr</u><br><u>ft<sup>2</sup></u> | <u>Btu/yr</u><br><u>ft<sup>2</sup></u> |
|---------------------------------|---|--|
| Baseline FY75                   | 0.209                                   | 209,000                                |
| FY79                            | 0.1887                                  | 188,700                                |
| FY80                            | 0.1882                                  | 188,200                                |
| FY85 (All Projects Implemented) | 0.1464                                  | 146,400                                |



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#### 6.4 PROJECT BREAKOUTS WITH TOTAL COSTS AND ECIP RATIOS

Table 6-5 summarizes the project costs, annual energy savings, and E/C and SIR ratios of all the EEAP projects studied. Values are taken from Tables 3-3 and 3-4.

The cost and savings values for the Increment G projects are given in terms of 1) portion of the projects not duplicated in the ECIP projects, and 2) (values in parentheses) total project values, including duplication with parts in ECIP projects. Totals are taken using the non-duplicating values.

TABLE 6-5

## PROJECT BREAKOUTS WITH TOTAL COSTS AND ECIP RATIOS

| ECIP<br>Project<br>Number | Project Name   | Project Cost<br>(FY84 - Not<br>Incl. Design)<br>(\$) | Annual Source<br>Energy Savings<br>(MBtu/yr) | E/C<br>Ratio<br>(MBtu/k\$) | SIR               |
|---------------------------|--|--|--|----------------------------|-------------------|
| A-1                       | Roof Insulation<br>Goldsborough Village                    | 197,871  | 4,574.6                                      | 23.1                       | 4.10              |
| A-2                       | Mechanical System Mods.                                    | 146,360  | 5,472.0                                      | 37.4                       | 5.72              |
| A-3                       | Electrical Projects  | 674,110  | 22,417.4                                     | 47.2                       | 9.49              |
| A-4                       | Deaerification   | 755,850  | 42,926.8                                     | 56.8                       | 12.56             |
| A-5                       | Convert to Central Chilled<br>Water System - Bldg. 72 & 82 | 866,470  | 8,845.0                                      | 38.5                       | 7.70              |
| A-6                       | Insulation & Weatherstripping                              | 775,740  | 33,233.7                                     | 42.8                       | 9.14              |
| -                         | EMCS (by V. L. Falotico, Inc.)                             | 1,290,695  | 53,690.0                                     | 41.6                       | Not<br>Calculated |
|                           | Sub-Total for ECIP Projects                                | 4,507,136  | 171,159.0                                    | 38.4                       | ----              |
| II. Increment C           |  |  |  |                            |                   |
| -                         | Additions to EMCS  | 93,060   | 2,950.6                                      | 30.6                       |                   |
| B-1                       | Push/Pull Windows - Duty<br>Cycling Bldg. 52A              | 0 (22,300)   | 0 (1,351.0)                                  | 60.6                       |                   |
| B-2                       | Duty Cycling - Bldg. 42                                    | 0 (19,510)   | 0 (1,338.0)                                  | 68.6                       |                   |
| B-3                       | Outdoor Air Cooling  | 0 (13,670)   | 0 (528.0)                                    | 38.6                       |                   |
| B-4                       | Economizer Cycle and Heat<br>Recovery - Bldgs. 22 & 82     | 10,250 (15,620)                                      | 203.3 (412.0)                                | 25.0                       |                   |
| B-5                       | HVAC Mods. - Bldg. 82                                      | 0 (21,790)   | 0 (803.9)                                    | 35.0                       |                   |
| B-6                       | Economizer Cycle and Duty<br>Cycling                       | 0 (18,380)   | 0 (353.6)                                    | 18.4                       |                   |
|                           | Sub-Total Increment C                                      | 193,310  | 3,053.9                                      | 30.9                       |                   |
| III. Increment E          | Operation & Maintenance Proj.                              | 95,192   | 19,397.0                                     | 203.8                      |                   |
| IV. TOTAL ALL PROJECTS    |  | 54,705,618   | 193,609.9                                    | 41.1                       |                   |

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### 6.5 GRAPHIC REPRESENTATION OF PRESENT AND PROJECTED ENERGY USE

Present (FY79) and projected energy use with EEAP energy projects is calculated by fuel type in Table 6-6. The results of these calculations are presented graphically in Figures 6-1 and 6-2:

Figure 6-1 (Pie Chart): Presents Annual energy consumption by fuel type for 1) FY79 (the first year detailed data was available) and 2) FY85 if all EEAP projects are implemented. Savings are indicated by the hatched area. Percentages are in terms of FY79 consumption.

Figure 6-2 (Bar Chart): The same information is presented as in Figure 6-1, but in addition total consumption for FY79 and FY85 is directly compared, as is total oil consumption.

Note: The percent reduction in Figure 6-1 of 21.8% differs from the 19.8% reduction given in Section 6.2. This difference is due to the fact that FY79 is used as the base year in Figures 6-1 and 6-2 whereas FY75 is used as the base year in Section 6.2. FY79 is the earliest year for which data for energy consumption by fuel type is available.

AND DO NOT LET IT BE KNOWN THAT YOU HAVE BEEN HERE

[illegible]

\* The dates are not for these projects are related to C.P. projects of the G.N. family and are not to be used for any other purpose.

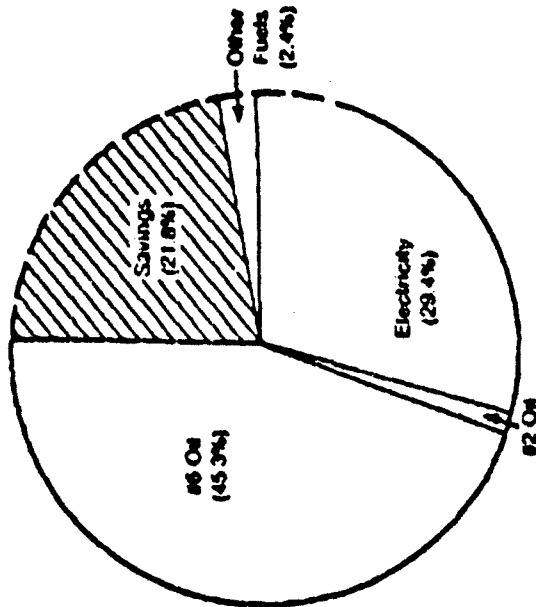
|              |         |       |          |         |        |        |
|--------------|---------|-------|----------|---------|--------|--------|
| Food of 1000 | 250 350 | 5 100 | 4 10 100 | 100 370 | 21 310 | 89 620 |
| Cost of 1000 | 25 30   | 1 01  | 40 30    | 29 40   | 1 40   | 70 30  |

|      |               |                 |
|------|---------------|-----------------|
| 1961 | • 109,905 01. | • 2 1097 = 0.1. |
| 1962 | • 110,905 01. | • 6 1107 = 0.1. |

WESTERN

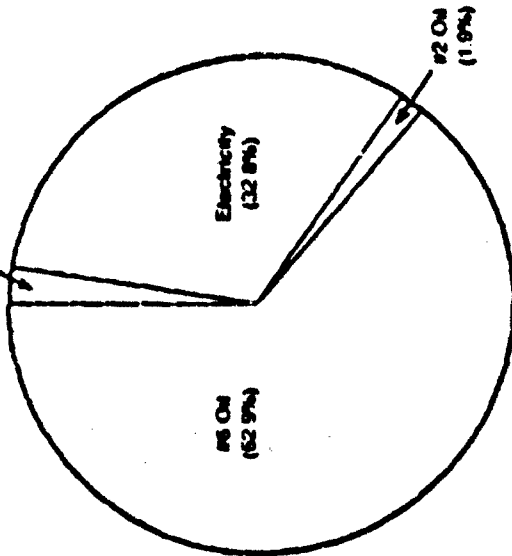
Other Fuels  
Gasoline  
Diesel Fuel  
Nat. Gas  
Propane

1.6%  
0.6%  
0.1%  
0.1%  
2.4%



Projected Energy Use with EEA's Energy Projects

Total 692.0 x 10<sup>9</sup> BTU - 78.2%

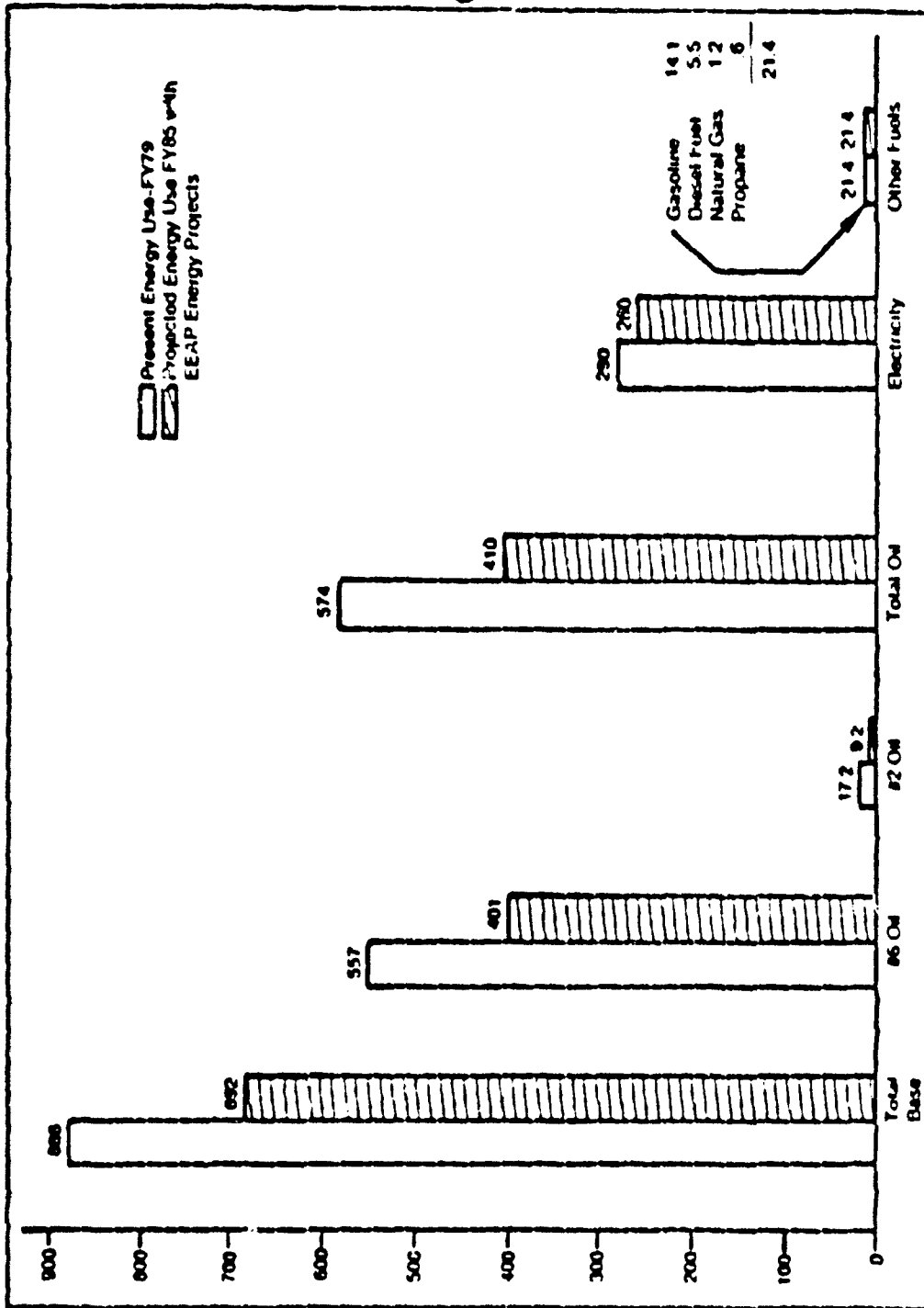


FY79 Energy Use

Total 885.6 x 10<sup>9</sup> BTU - 100%

MILITARY OCEAN TERMINAL, BAYONNE NJ (MOOTBY)  
FY79 AND PROJECTED FY79 PERCENTAGE OF ANNUAL ENERGY USE BY FUEL TYPE

WESTEN



MILITARY OCEAN TERMINAL, BAYONNE NJ (MOTBY)  
 FY79 AND PROJECTED FY85 ANNUAL ENERGY USE BY FUEL TYPE  
 VALUES IN TERMS OF 10<sup>3</sup> BTU : 1000 = MBTU



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